

REVIEW ARTICLE OPEN ACCESS

Importance of Regulatory Frameworks for the Achievement of the Objectives of Modified Taungya System (MTS) in Ghana: Lessons From the United States and Canada

Richard Kwadzo Asare¹  | Selase Kofi Adanu¹ | Maxwell Kwame Boakye¹  | Joana Ameyaw² | Daniel Brain Akakpo³

¹Department of Environmental Science, Ho Technical University, Ho, Ghana | ²Department of Silviculture and Forest Management, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana | ³Department of Crop Science, University of Ghana, Legon, Accra, Ghana

Correspondence: Richard Kwadzo Asare (rkasare@htu.edu.gh)

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ABSTRACT

Regulatory frameworks are systems of laws, regulations, and procedures that influence how organisations operate. A good regulatory framework is important for efficient service delivery and the achievement of the objectives of an institution/organisation as well as helping meet required standards. Published works by forest researchers have basically written on finding solutions to the challenges of Modified Taungya System (MTS) encountered by MTS farmers which forms part of internal operations at Forestry Institutions. The question is who checks whether the findings (solutions to MTS challenges) are implemented by the management of these forestry institutions? More importantly, institutional regulators are not part of the organisation's internal operations or management. For instance, all public tertiary institutions in Ghana have their internal management operations. However, Ghana Tertiary Education Commission (GTEC) is the regulator which helps in ensuring quality and standards at all tertiary institutions. This study adopted a systematic literature review which made use of quantitative data and textual information. The study also adopted the use of Boolean operators in searching for literature in scientific databases such as Scopus, Web of Science and Google scholar. The findings indicate that Ghana's current Forestry Commission (FC) oversight of MTS lacks systematic performance monitoring to inform future decisions on how to improve upon it. It also found that establishing forest regulatory authority requires specific institutional prerequisites.

1 | Introduction

Modified Taungya System (MTS) has a long history which started from Burma (now Myanmar) where degraded forest lands were given to farmers to plant trees and grow food crops until canopy is formed [1]. This started in the mid-1800s and it was referred to as Taungya System (TS). By then, the TS was an improvement to the traditional shifting cultivation in Myanmar. During the early days of plantation development food crops were cultivated together with trees and this activity became known as the concept of TS [2]. In Ghana, this concept was introduced in the 1930s,

unfortunately it was not able to achieve the purpose for which it was introduced and, because of this, it was terminated in 1984. The termination was because of the lack of supervision by management of Forestry Commission (FC). Prior to the introduction of the TS to Ghana, it was introduced in two African countries, which are Nigeria in 1920 and Kenya in 1910. Some African countries including Nigeria and Kenya could not continue with the TS farming because of lack of incentives and support [3]. In order for it to meet its objectives, it was revised and re-introduced in 2002, which till now is referred to as the

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Modified Taungya System (MTS) [4]. The objective of the MTS is to improve the livelihood of rural folks through the cultivation of trees and growing of food crops. Farmers obtain revenues from the sale of the timber/trees when they mature for harvesting, and subsistence from the food crops, sometimes sold in the market for income [5]. Other benefits accruing from forest activities apart from timber revenues form part of the MTS include mushrooms, livestock, honey/bees and the revenues made from the sale of these commodities [5]. Because MTS is a concept that promotes the planting of trees and the growing of crops, rural folks whose livelihoods depend directly on forest resources like fuelwood take up the responsibility to protect and conserve the forest [6]. Agroforestry practices such as MTS also play significant roles in ecosystem services such as the provision of food and its accompanying pollinator support systems [7]. Registered farmers under the MTS programme are given degraded plots of land for the planting of trees and growing of food crops until the canopies of the trees close. Forest-based initiatives came into existence with the goal of restoring degraded forest lands with economically viable timber species [7] and with staple food crops for subsistence.

Farmers registered in the MTS are entitled to 50% revenue from timber and also entitled to 100% of the proceeds from the crops [8]; 15% of the plantation proceeds is given to owners of the plots of land and 5% are given to indigenes around the forest areas [8]. Since the MTS is a revised form of the old TS, it allows farmers to have entitlement of the trees until they mature for harvest unlike the old TS where farmers no longer have co-ownership to the revenues from timber plantation after 3 years [7]. However, the MTS also comes with its own challenges. Acheampong et al. [7] reported that the MTS is also not achieving its objectives as a result of farmers not receiving income until trees are harvested and canopy closure, and lack of support and supervision from the implementing agency (FC) all contribute for the MTS not able to achieve its objectives. According to Narh [1], the current FC structures have not addressed these operational problems. Narh [1] indicated that MTS still has major setbacks, which hinder it to fully realise its objectives. These setbacks include nepotism, corruption, bribery and overdue delay in the signing of benefit sharing agreement with farmers. In this regard, the MTS still needs to be further revised in order that it can meet its objectives [1]. FC has failed to make the MTS yield the intended outcome for which it was developed from the failed erstwhile TS. It seems the FC has not learnt lessons from the challenges of the TS [1]. In response to these challenges, Acheampong et al. [7] proposed an effective collaboration of expertise between Forest Services Division (FSD) of the FC and the Agricultural Division of Ministry of Food and Agriculture (MOFA). This collaboration will help farmers generate income between tree canopy closure and when trees (timber, teak, etc.) are harvested [7].

In Myanmar, the state has ownership of all forest lands which is then managed by the Forest Department. In order to make the best use of the forests in Myanmar, Community Forestry National Working Group was established in 2015. This was with the intention of stakeholder consultation aimed towards a successful community forest development [9]. As a result of this, in 2022, there was an increase in the number of community forests which exceeded 400,000 hectares. Myanmar is currently working towards attaining 919,000 hectares by 2030, and this is part of Myanmar's position with international bodies like the Paris

Agreement, 2015. Unfortunately, Myanmar could not achieve the maximum benefits of TS due to weak policy implementation [10]. Political actors only pay lip-services to the development of community forestry, but do not meet the desired expectations regarding implementation [9]. Another very revealing in relation to community forestry initiatives in Myanmar is that district forestry officers must be persuaded before they can carry out their mandatory roles [9].

Currently, Myanmar (formerly Burma) still practises the old TS because farming because of the economic respite it offers them. However, a recent study by Han et al. [11] indicated that land governance systems should acknowledge communal rights, and not a top-down approach decision process [11]. This is the same story for the people of Shan State in Myanmar who also till date over-depend on the natural resources for firewood, growing of food crops and planting of trees due to increase in their population [12]. This also has a toll on the environment and re-emphasises the need for a regulatory body to ensure quality and standards of farming and livelihood operations of agencies and institutions. Myanmar, Ghana and Kenya are developing countries who need the fundamental necessities of life that will enable them improve on the quality of life of their people. Myanmar, Ghana and Kenya are challenged by the United Nations to achieve the Sustainable Development Goals (SDGs) by 2030 [13]. More important to this study, Myanmar, Kenya and Ghana have a common meeting place of a farming method known as the TS; the TS is currently operational in Myanmar, Kenya and Nigeria (as stated above). MTS which is currently practised in Ghana was born from the traditional TS (as stated above), and this gives this paper an international prominence considering the history of the present MTS.

Though there are studies conducted by some scholars, for example, Reference [7] (as reported in this literature above), on ways of making the MTS meet its objectives, analysis of FC data reveals significant implementation gaps. Between 2018 and 2023, only 34% of allocated MTS plots achieved target stocking density of 1100 stems/ha, compared to 67% success rate in state forest plantations under direct FC management (FC Annual Report 2023, p. 45). Farmer interviews in three districts revealed that 78% had not received promised technical support visits within the past 12 months, indicating systematic supervision failures.

A PhD study carried out by the first author (mixed-method study) of this paper in Kabakaba Forest Reserve also shows that there is no effort by the FC to improve the livelihoods of the people.

This is because there is very little collaboration between the agencies listed above by Acheampong et al. [7] to help farmers generate income between canopy closure and tree maturation for harvest. Table 1 is a well-documented list of farmer complaints/grievances in various forest sites in Ghana.

The findings from the first author's 4-year studies at Kabakaba Hills Forest Reserve (KHFR) informed this review paper. KHFR is well noted in the literature for practising MTS; however, findings from the first author's survey reveal a disconnect between policy (theory) and reality. Many of the respondents (farmers) in KHFR only practise subsistence (or household farming), and not MTS. The findings conducted by the first author lasted between 2022 and 2025 through the adoption of research by immersion. With this background, it puts this paper

TABLE 1 | Farmer complaints in various forest study sites.

Problem	Forest reserve and respondents (%)	Proposed solutions
High but unpaid labour input for tree planting and maintenance	Tano Offin (32.6%) and Tain II (18.2%)	Advance payments of the 40% (now 50%) to compensate for the work done. Income-generating projects (“alternative livelihood ventures”) like animal rearing. Grants or soft loans to cater for part of the planting and maintenance costs, to be paid back from the 40% (now 50%) timber benefit share.
Long distance from home to planting sites with moderate performance in MTS farm maintenance due to fatigue being the result	Yaya (3.1%) and Tain II (18.2%)	Provision by government (FC) of transportation (tractor) services at moderate costs
A lack of working tools	Yaya (9.4%) and Tain II (45.5%)	Provision by the FC of cutlasses and Wellington boots, as an incentive to participation in the scheme
Bad infrastructure, which prejudices possibilities of growing commercial food crops like maize, plantain and yam	Yaya (18.8%) and Tain II (18.2%)	Improve and regular maintenance of roads and bridges that cross feeder roads to the plantation sites
Irregular allocation of degraded forest area for the MTS	Tano Offin (55.8%)	Timely and regular allocation of degraded forest land until all the degraded land has been reforested
Untimely and irregular supply of tree seedlings leading to a delay in tree planting	Tano Offin (5.8%)	Local seedling production instead of contracting outsiders
Weak condition of tree seedlings provided from outside	Tano Offin (3.5%)	Seedling production close to the planting sites
Fertility loss of MTS plots after the 1st year and disappointing food crop yields in some plots	Tano Offin (2.3%)	Closer inspection of soil quality prior to land allocation
Lots of gravel and stones on some plots	Tano Offin (1.2%)	Closer inspection of soil quality prior to land allocation
Quick tree growth, reducing the time available for food cropping	Tano Offin (1.2%)	A combination of quick and slow-growing species and inclusion of species with smaller crowns
Slow teak growth due to a lack of thinning	Yaya (3.1%)	Training and guiding of farmers to undertake this task. Strict by-laws and management plans for tree farm maintenance as part of the agreement. More effective monitoring by the FC and MOFA.
Health risks associated with tree planting and maintenance (cutlass wounds, snake bites)	Yaya (3.1%)	Better medical care
A lack of sources of water for fire extinction at the plantation sites	Tain II (8.3%)	Provision of water sources (boreholes) at the plantation sites
Fire risks	Yaya (3.1%)	Plantation boundary clearing prior to the dry season, fire volunteer squads, fire belts

Note: Adapted from Reference [7].

into its proper context as the big question arises that who checks and ensures that quality and standard of forestry initiatives (e.g., MTS) are met by the FC? For instance, in Germany, forest regulators have a significant impact on forestry institutions by making sure that forest resources are protected through the establishment of legal frameworks. This ultimately has an impact on how forestry institutions operate and manage their forests. These forestry regulators are empowered by the Federal Forest Act. Länder Forestry Laws (State Laws) also complements the Federal Forest Act, which aids in the provision of specific regulations for each region. These regulations have a huge impact on forestry institutions as they are obliged to meet standards like the protection of biodiversity and promotion of sustainability activities. The role of forest certification, an independent third-party audit and assessment against specific standards ensures sustainability in the management of forests. Forest certification comes in the face of increasing forest degradation solely for economic needs. Forest certification emerged as a regulatory mechanism to uphold the fundamental pillars of sustainable development [14]. Certification of forests also helps in safeguarding ecosystem services such as provisioning, regulatory, support and cultural services [15]. Certification of forests is also considered as a marketing control mechanism for strengthening the value chain of forestry operations [16]. This exposes the importance of these regulatory frameworks in the achievement of forestry objectives (e.g., MTS) in Ghana.

1.1 | Research Objectives

1. To examine the impact of independent regulatory oversight responsibility on forestry operations.
2. To investigate how independent regulators help improve the fundamental pillars of sustainability: environmental, social and economic.
3. To ascertain the impact of certification systems in other jurisdictions on forestry outcomes.

2 | Methods

2.1 | Conceptual Framework

This study can be well understood within the context of the roles that independent forest regulators play in the management of forest operations. Forest institutions serve as the mouthpiece/representative of central government in managing forests sustainably. However, the practical situation in Ghana does not align fully with the primary objectives for the existence of these forestry institutions (based on empirical data provided in the literature). This brings the importance of an independent forest regulator to help influence positively on forestry outcomes in the various forest fringe communities.

In this conceptual framework relationship, it considers trained human resources equipped with forestry skills/knowledge, infrastructural resources and political independence as independent variables, independent regulators as mediating variables and forest restoration, food security and economic benefits as dependent/outcome variables. The diagrammatic illustration is represented in Figure 1.

2.2 | Methodology

Systematic review was used in this study for the purposes of replicability and thoroughness of the review process. PRISMA, known as the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, was employed in the study for its comprehensive search procedure. The credibility of the review process is made possible by PRISMA, which helps meet criteria of requirements. It also makes the search process transparent. This systematic process is useful with the criteria for selecting articles, data query and strategies for data extraction and analysis.

2.3 | Literature Search

A comprehensive search was carried out in scientific databases such as Scopus, Web of Science, Google Scholar and grey literature/reports from well-respected independent and international organisations. The search strategy used Boolean logic with keywords and phrases such as 'forest certification AND regulators', 'regulatory frameworks AND forestry AND Ghana', 'Modified Taungya System AND regulators', 'Independent third-party forest certification' and 'Forest Stewardship Council OR impacts OR forest certification'. Precise keywords related to MTS include 'Modified Taungya System practice in Ghana' and 'Modified Taungya System challenges AND Ghana'. A search validation procedure was used in order that the retrieved information is relevant to the study of independent forest regulators in the sustainable practice of MTS. The search validation procedure include: (i) the use of very relevant papers in the practice of TS and (ii) intermittently varying keywords based on initial results and use of additional search strategies in the form of phrases in order to retrieve relevant papers for the study (e.g., grey literature from the World Bank Reports).

The method adopted in this study is crucial in retrieving relevant literature and also provides a systematic and transparent method for the search strategy.

2.4 | Inclusion and Exclusion Criteria

The purpose of inclusion and exclusion criteria is important to collect literature that help answer the research questions of this study. It helps in providing more refined search results from primary research papers, review papers and grey literature/reports from internationally recognised organisations. Majority of the search was carried out from the early 2000s to 2025. Few searches were conducted before 2000–2025. These few studies before 2000 provided a foundational understanding regarding the erstwhile TS, its underlying concept and its modernised MTS.

The inclusion and exclusion criteria are in Table 2.

2.5 | Quality Assessment of Study

Literature was retrieved from the scientific database using systematic process. Standard data extraction instrument was used by the authors of this paper. Thorough analysis was carried out in order that the obtained literature answers the research questions. In all, 32 articles have been cited in this study. Table 3 shows all the 32 articles considered in this study with their themes/significance to the study.

The final set of data extraction instruments consist of study areas such as: practice of MTS in Ghana, impact of

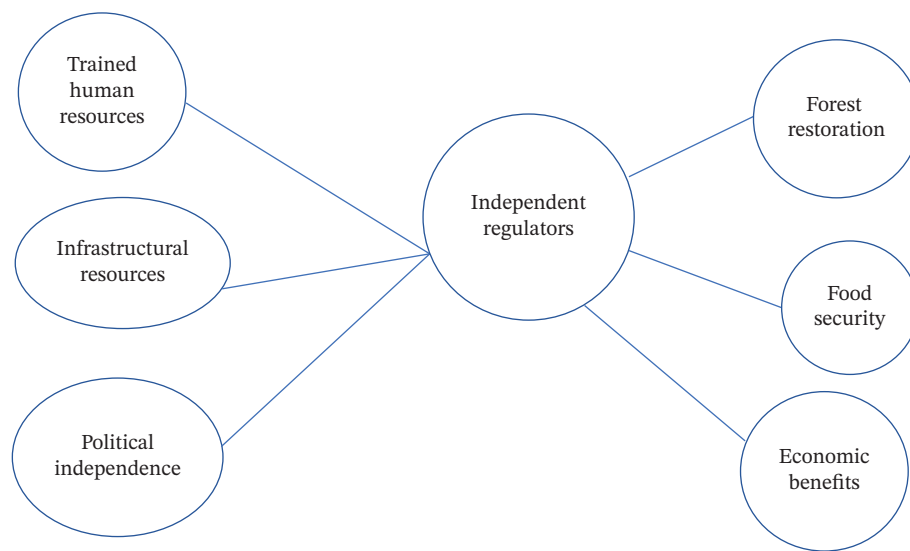


FIGURE 1 | Policy analysis or conceptual framework illustrating the operationalisation of independent third-party forest regulator.

TABLE 2 | Inclusion and exclusion criteria.

Inclusion criteria	Indicator for inclusion
Search strategy	Keywords using Boolean operators
Time period between	1991 and 2025
Types of research document	Original works, review studies, grey literature, institutional reports from independent organisations.
Research niches	Forest certification and regulations, practices of MTS in Ghana, impact of independent third-party regulators on MTS
Exclusion criteria	Reasons for rejection
Areas of study	Studies not related to independent forest certification, practices of MTS
Accessibility	Articles without full-text access/articles with closed access.

independent third-party forest certification, challenges of practising MTS in Ghana, resources required for the establishment of independent third-party forest certification. In order to uphold the credibility and reproducibility of the data extraction instruments, colleagues who are not part of this study reviewed it. Quantitative data in this study were helpful in retrieving the sustainability outcomes of independent third-party forest certification in Canada and the United States. Textual information was also useful in providing the experiences of people registered under the MTS: challenges and recommendations. Drawing insights from the quantitative data on the sustainability of outcomes of independent third-party certifications, recommendations have been provided by the authors on how its implementation will improve the outcomes of the MTS. In Ghana, a well-respected independent regulator in the tertiary level (GTEC) has been cited as a good example and reference for this study. This implies that, if GTEC is ‘helping to restore the credibility’ of tertiary education in Ghana, same can be done for the forestry sector.

In this review study, PRISMA has been used to extract relevant data critical to answer the research questions. The flowchart of literature inclusion adopted from PRISMA is indicated in Figure 2.

3 | Results

3.1 | Impact of Forestry Regulations on the Economic, Social and Environmental Impacts of Forestry Institutions

The 1992 United Nations ‘Earth Summit’ brought together global leaders from countries all over the world to harmonise economic development and environmental protection. However, there was no definite agreement on how to manage forest resources sustainably. This failure led to the establishment of the Forest Stewardship Council (FSC) in 1993 to promote the three (3) pillars of sustainability in forestry through certification [29]. Many tropical African forests which are under the regulatory frameworks of FSC show improved environmental compliance such as minimal to zero deforestation and logging activities. Again, with FSC regulatory guidelines, there is also improved living standards of employees as well as forest communities [31]. The implementation of FSC framework has a good positive outcome on business enterprises such as increase in customer satisfaction index and employees’ welfare. This is associated more with businesses whose operations are sourced from forests [30]. The establishment of FSC was made possible by the hard work and commitment of non-governmental organisations

TABLE 3 | Cited 32 considered articles.

Cited 32 considered articles	Themes
1 [15]. (ref. 19)	Ecosystem services
2. Paudel et al. [17] (ref. 20)	
3. Thaug [9] (ref. 24)	
4. Acheampong et al. [7] (ref. 1)	Taungya System, MTS and forestry financing
5. Adjei et al. [4] (ref. 2)	
6. Agyeman [8] (ref. 3)	
7. Appiah et al. [18] (ref. 4)	
8. Kalame et al. [5] (ref. 11)	
9. Nair [2] (ref. 14)	
10. Narh [1] (ref. 15)	
11. Win and Kumazaki [10] (ref. 27)	
12. Wiro and Ansa [3] (ref. 28)	
13. World Bank [19] (ref. 30)	
14. World Bank Group [20] (ref. 31)	
15. Yeboah et al. [6] (ref. 32)	
16. Fuseini et al. [16] (ref. 8)	
17. Han et al. [11] (ref. 10)	
18. Moral-Pajares et al. [21] (ref. 13)	
19. Sharma et al. [12] (ref. 23)	
20. Cashore et al. [22] (ref. 5)	Forest certification
21. Fernholz et al. [23] (ref. 6)	
22. FSC Africa [24] (ref. 7)	
23. Halalisan et al. [25] (ref. 9)	
24. Moore et al. [26] (ref. 12)	
25. Newson et al. [27] (ref. 16)	
26. Osei [28] (ref. 17)	
27. Rotherham [29] (ref. 21)	
28. Santoso et al. [30] (ref. 22)	
29. Tritsch et al. [31] (ref. 25)	
30. Tsanga et al. [32] (ref. 26)	Sustainable development
31. Palmer [13] (ref. 18)	
32. Wolff and Schweinle [14] (ref. 29)	

(NGOs), environmentalists and other independent associations [22, 26]. This subjects forestry institutions to regular audits by independent third-party certification bodies in a bid to meet the standards of FSC. FSC also makes impact by educating stakeholders in the forestry sector about the importance of sustainable forest management [29]. FSC regulates forestry institutions by ensuring that forestry institutions meet a set of standards that are environmentally friendly, economically viable and socially acceptable in their operations. Thereafter, other forest certification bodies were also established. Example is the Sustainable Forestry Initiative (SFI) which offers accreditation to forestry institutions to carry out their operations in a sustainable manner. This provides a market value for certified organisation's forest products since consumers patronise forest products from organisations that adhere to sustainability standards. SFI was developed in the United States and Canada. As a result of these

initiatives, it is estimated that close to 8% of forests globally have been accredited by forest regulators. Globally, upholding to the fundamental pillars of sustainability in forestry are sovereign in policy directives. However, discussions all over the world seek to ascertain whether these certifications by forest regulators have met and possibly improved the environmental, economic and social needs of society, and whether the various forestry regulatory frameworks are achieving their common objectives [26].

As stated in the literature above, there is no mechanism in Ghana to check whether suggestions by Acheampong et al. [7] (as well as other researchers) have been implemented by the forestry institutions with measurable outcomes. Elsewhere in the world like the United States and Canada, there are regulatory bodies that oversee the operations of forestry institutions. Few studies have been carried out on the impact of forest regulatory bodies on

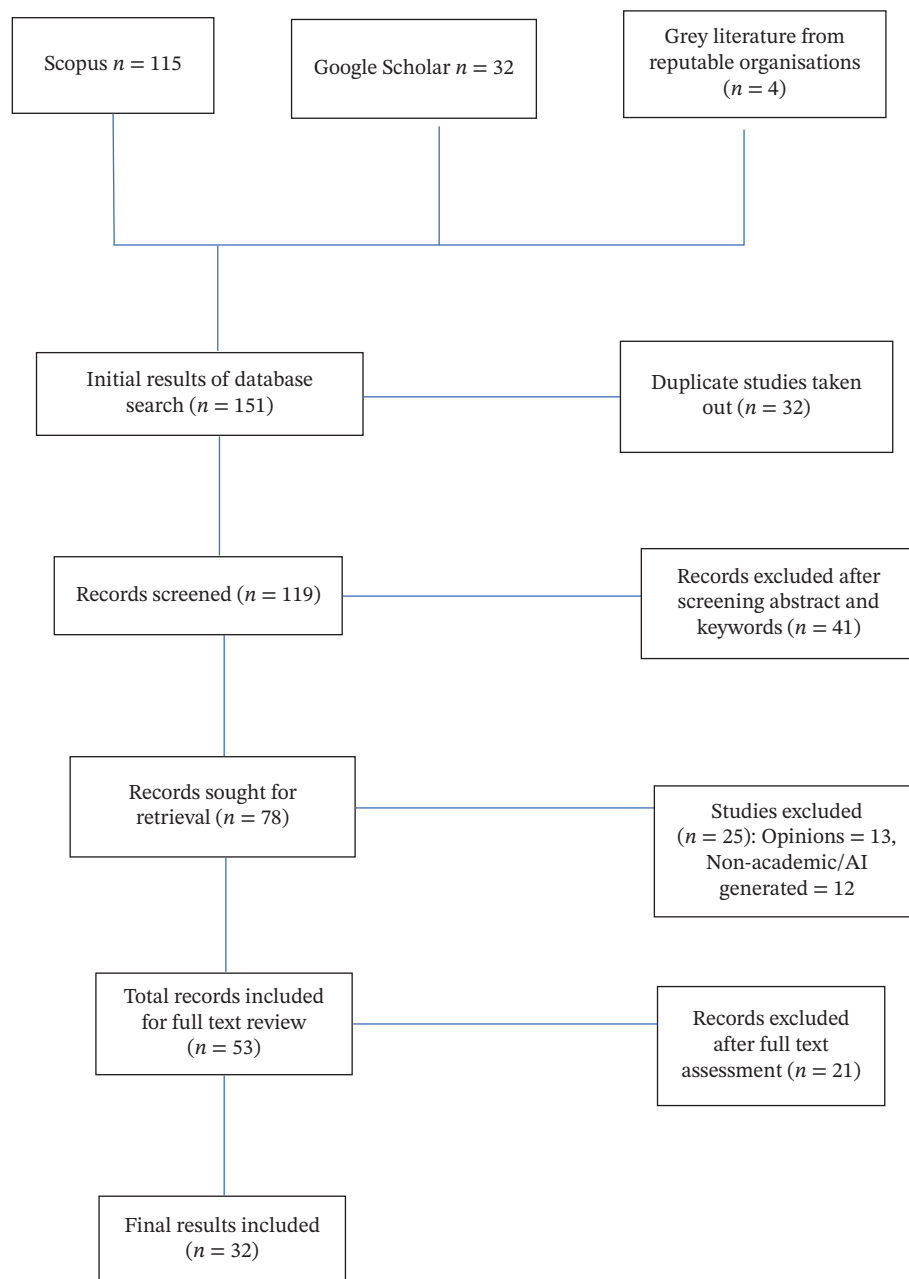


FIGURE 2 | Flowchart of literature inclusion adopted from PRISMA.

forest management practices and if the impact are statistically different between FSC and SFI [26]. FSC and SFI have criteria for meeting the fundamental pillars of sustainability [23]. The study conducted by Moore et al. [26] consisted of investigations about the institutional operations with respect to if any impact was observed in all three pillars of sustainability (environmental, social and economic). Outcomes on managerial/operational changes were investigated against FSC and SFI requirements. The options for the respondents to select from were ‘Yes/No/Specify’.

Results from Moore et al. [26] show that FSC-certified forest practitioners in the United States made an average of 12.7 with regards to adhering to the tenets of sustainability-environmental, economic and social practices, while SFI-certified forest practitioners in Canada also had an average of 13.9 as overall

managerial impacts in environmental, social and economic out-turns. These impacts were not only limited to the larger organisational outlook but also evident in individual practices under both FSC and SFI.

Irrespective of the total slight margin difference between the overall impact made by both FSC- and SFI-certified institutions, FSC demonstrated more environmental/forestry management impacts compared with SFI, as shown in Table 4 (6.60 against 5.80, respectively). Organisations certified by FSC also demonstrated more social impact as shown in Table 4 (2.96 $\approx$ 3.0) compared with SFI (2.59 $\approx$ 2.60). There was also more economic out-turn by organisations certified by SFI, as shown in Table 5 with 5.54 $\approx$ 5.50 for SFI, while 3.09 $\approx$ 3.10 for FSC. These two forest certification systems have impacted the operations of forestry organisations economically, socially and

TABLE 4 | Environmental/forestry systems under both FSC and SFI certification systems.

Change in environmental or forest management practice required?	FSC		SFI		p-value for two-sample pooled Z test of proportions
	No. of yes responses	Respondents (%)	No. of yes responses	Respondents (%)	
No. of replies	56		41		
Forest management plan	43	76.8	10	24.4	< 0.0001
Old-growth/high conservation reserves	31	55.4	10	24.4	0.0023
Implementation/effectiveness monitoring	30	53.6	25	61.0	0.4654
Forest inventory programs	24	42.9	7	17.1	0.0071
Geographic information systems	20	35.7	13	31.7	0.6818
Sustained yield/allowable cut	20	35.7	15	36.6	0.9283
Special sites reserves	20	35.7	15	36.6	0.9283
Prevention of exotic invasive	20	35.7	10	24.4	0.234
Growth and yield calculations	19	33.9	7	17.1	0.0643
Chemical safety, reduction, disposal	19	33.9	9	22.0	0.1971
Use and monitoring of BMPs	19	33.9	23	56.1	0.0293
Threatened species protection	17	30.4	11	26.8	0.7039
Biological diversity planning	17	30.4	16	39.0	0.3735
Soils and inventory maps	16	28.6	10	24.4	0.6455
Determining clear-cut size	11	19.6	14	34.2	0.1074
Site productivity protection	10	17.9	4	9.8	0.2627
Meeting green-up standards	10	17.9	20	48.8	0.0011
Reforestation/afforestation	7	12.5	7	17.1	0.5287
Reduced forest type conversions	6	10.7	4	9.8	0.8808
Meeting plantation guidelines	5	8.9	4	9.8	0.8887
Forest health protection	4	7.1	4	9.8	0.6455
Eliminating GMOs	3	5.4	0	0.00	0.1310
Total of yes responses	371		238		
Average per owner for class	6.63		5.80		

Note: Statistically different percentages at $\alpha = 0.10$. Source: [26].

TABLE 5 | Impacts made on social/legal practices under both FSC and SFI certification systems by certified organisations.

Change in social or legal practice required?	FSC		SFI		p-value for two-sample pooled Z test of proportions
	No. of yes responses	Respondents (%)	No. of yes responses	Respondents (%)	
No. of replies	56		41		
Public release of management plan	22	39.3	6	14.6	0.008
Consulting with communities/neighbours	21	37.5	6	14.6	0.0131
Public/stakeholder meetings	20	35.7	8	19.5	0.0819
Legal planning and record-keeping	16	28.6	11	26.8	0.8493
Program reporting	16	28.6	27	65.9	0.0003
Protecting indigenous rights	15	26.8	7	17.1	0.2585
Public relations/education	11	19.6	11	26.8	0.4065
Outreach and extension	9	16.1	9	22.0	0.4593
Social impact analyses	7	12.5	5	12.2	0.9601
Offer program workshops	7	12.5	6	14.6	0.7642
Comply with international treaties	5	8.9	1	2.4	0.1902
Ensuring labour rights and practices	4	7.1	0	0.00	0.0801
Community grants and support	4	7.1	4	9.8	0.6455
Protection from illegal trespass	3	5.4	1	2.4	0.04777
Compliance with social/worker laws	3	5.4	1	2.4	0.4777
Comply with environmental laws	2	3.6	3	7.3	0.4122
Establishing tenure rights	1	1.8	0	0.00	0.3898
Total of yes responses	166		106		
Average per owner for class	2.96		2.59		

Note: Statistically different percentages at $\alpha = 0.10$. Source: [26].

environmentally, with one system having a stronghold on each out-turn (environmental, social and economic) over the other. Nonetheless, these impacts were made in each certification system.

In summary, management of the forestry institutions is of the opinion that forest certification achieves its objectives of environmental, social and economic indicators. Forestry organisations also express their willingness to re-certify their accreditations with FSC and SFI [26]. Separate surveys (certified and uncertified forest resources) carried out in the United States also reported that conservation of species and the protection of the environment improved under certified forest areas managed by organisations which are certified [26]. Table 4 represents the impacts made on environmental/forestry systems under both FSC and SFI certification systems by certified organisations.

Table 4 shows the certification systems with higher impact on environmental/forestry practices on organisations as well as the one requiring more of this change (environmental/forestry) on organisations.

As the cardinal pillars of sustainable growth demands, the social/legal pillar has to do with the social issues specifically 'people-friendly posture'. In this regard, importance is placed on the social/legal performance of the certification systems, and this is indicated in Table 5.

Table 5 shows the certification systems with higher impact on social/legal practices on organisations as well as the one requiring more of this change (social/legal) on organisations.

Every human activity focuses on the provision of job opportunities/in other words generating revenues for development. The objective of every forestry project is the creation of sustainable livelihood opportunities. In this regard, Table 6 shows the certification systems with higher impact on the profit margins of organisations.

Table 6 shows the certification system yielding higher economic impact on organisations as well as the one requiring more of this change (economic increase).

Taking a cue from the regulatory frameworks in the United States and Canada that has proven significant levels of sustainability in the forest sector, Ghana as a nascent/developing country can also improve upon/adapt an 'available regulatory structure' or use an 'available regulatory structure' as a conduit in implementing independent third-party monitoring compliance (FSC). The World Bank played a significant role in the development of the revised MTS in Ghana in 2002. The World Bank did this through collaboration with the Food and Agriculture Organization (FAO). Forestry projects implemented by the World Bank are reviewed regularly to monitor the implementation progress of forestry projects in the various communities [19]. Forestry projects implemented by the World Bank are reviewed regularly to enhance the economic potential of forests, thus improving the quality of life of forest people [21]. The World Bank has quite a number of ways of verifying whether forestry and livelihood projects are meeting their intended outcomes. One of such ways is through monitoring and evaluation (M&E) [19]. World Bank provides technical skill training, forestry skill training and the business development of forestry products.

Local communities in the Afram Headwaters Forest Reserve are beneficiaries of an agroforestry initiative—MTS [20]. Also a similar place in Ghana like Pamu-Berekum under the practice of the MTS recorded gains in land restoration [18]. The implementation of the agroforestry project in Afram Headwaters Forest Reserve was impactful because of the keen monitoring framework of the project by the World Bank. Just as how the agroforestry project in Ghana's Afram Headwaters Forest Reserve was impactful through the implementation of the World Bank, FSC certification systems can also be spearheaded by the World Bank. This will help ensure an internationally recognised standard for forest products and operations in Ghana. However, the role of the World Bank will help to adapt these internationally recognised standards at the national, regional and local levels. This will help reflect the various environmental, economic and social requirements of forests in different parts of the world. Interestingly, there is an interim FSC forest stewardship standard in Ghana currently [28].

With regards to the implementation of the MTS in Ghana, FSC standard will ensure that the production of wood and non-wood products is environmentally sourced. The social benefits from this FSC third-party audit model with regards to the operations of MTS will ensure that both the local forest people and community at large enjoy long-term benefits. FSC will also ensure that the operations of MTS are largely profitable to the local people. All these gains will be achieved through independent forest monitoring compliance.

3.2 | Assessment of the Impact of Certifications: The Role of Human Resources, Logistical Tools and Capacity Building

Evaluating the impact of forest certification on firms may require assessing the management procedures or audit reports of certified forest organisations/from private individuals. This procedure has largely been used especially for FSC audit procedures [27]. Fundamental to any forest regulatory process is an independent evaluation of how forest resources are managed with regards to the certification systems. There are acceptable practices that are highly recommended when harvesting forest resources, planting of trees, application of agrochemicals, engaging with workers in the various forest communities, visiting forest sites to ascertain that forest managers adequately operate forests according to the standards of the certifying body. This is followed by documentation. Independent assessors evaluate whether management conforms to the standards required of them. The assessor provides a formal written report on whether the forestry operations/forestry products meet regulatory standards [26]. Reports of regulators contain objective outcomes which enable even certified forest organisations to improve upon specific standards that they have fallen short of. Therefore, regulators do not automatically approve certified organisations. The benefit of forestry audit provides certified organisations the opportunity to improve on sustainable forestry practices that meet the socio-economic and environmental pillars of forestry [25]. Standards such as management operations, monitoring and inventory usually require change more often under FSC regulatory system in the United States [27]. This is followed by issues of environmental sustainability. However, the issue of best management practices (BMP) was the least that require improvement/change for organisations under the regulatory systems [26].

TABLE 6 | Increase in economic benefits under both FSC and SFI certification systems by certified organisations (responses from the organisations).

Change in economic or system implementation required?	FSC No. of yes responses	FSC respondents (%)	SFI No. of yes responses	SFI respondents (%)	p-value for two-sample pooled Z test of proportions
No. of replies	56		41		
Chain-of-custody implementation	36	64.3	15	36.6	0.0069
Internal program monitoring/auditing	26	46.4	28	68.3	0.0324
Natural heritage planning/reserves	24	42.9	15	36.6	0.5353
Implementation committee/program commitment duties	17	30.4	32	78.1	0.0001
Management review system	17	30.4	26	63.4	0.0012
Continuous improvement	13	23.2	22	53.7	0.0021
Customer inquiries/procurement	11	19.6	18	43.9	0.0099
Logger/supplier training	9	16.1	31	75.6	0.0001
Economic analyses	8	14.3	5	12.2	0.7642
Forest research/demonstration	5	8.9	13	31.7	0.0044
Wood procurement plans/practices	4	7.1	14	34.2	0.0007
Utilisation planning and practices	2	3.6	3	7.3	0.4122
Minimising wood waste	1	1.8	5	12.2	0.0357
Total of yes responses	173		227		
Average per owner for class	3.09		5.54		

Note: Statistically different percentages at $\alpha = 0.10$. Source: [26].

Workers who are engaged to work with regulatory bodies, FSC as an example, undergo frequent training on Occupational Health and Safety (OHS) practices. It is an integral part of the management of human resources because visit on forestry sites comes with working with thorny plants which may cause wounds/cuts to the workers [24]. OHS procedures are reviewed and revised usually after workers are involved in serious accidents. It also makes provision for workers' welfare in these unfortunate incidents [24]. As expected of any regulatory body, they also take a keen look at the expertise of its own human resources in evaluating forestry operations as well as forestry institutions [24].

In order for forest regulators to help forest managers achieve their objectives, the role of logistical tools are indispensable. This is important because the role of logistical tools is intertwined and inseparable from the roles of regulatory authorities in ensuring sustainable forestry management. Logistical tools are useful in determining the quality of wood, canopy density, the height of trees, density of timber, biomass and volume of trees [32]. Forestry companies under the certification programme acknowledge the role human and logistical resources play in achieving the objectives of forest regulations [32]. FSC certification provides a peaceful and transparent platform for consensus building between forestry authorities and forest communities [32]. In Ghana, logistical tools for FSC certification can include: use of FSC trademarks for the purposes of identification and branding for forest products that are sustainably sourced from the field. The use of audit procedures should be conducted by third-party certified field assessors to conduct field assessments that involve production and manufacturing. This will help to scrutinise forest operations before certification, as well as in the identification and segregation of FSC-certified forest products from non-certified forest products throughout the production, manufacturing and distribution activities. Assessors to carry out these operations will be trained and well equipped with skills such as the use of forestry skills like geographic information system (GIS). The application of GIS also helps visualise and monitor accredited forest areas. GIS is also useful in the monitoring of forests by the use of spatial data for analysis. These spatial data for expert analysis provide authentic information to foresters which enables them to make informed decisions about forest management. Data on forests can be updated by remote sensing/field surveys.

Establishing effective forest regulation requires addressing three institutional prerequisites: (i) Technical capacity—Independent monitors need forestry expertise currently concentrated within FC, and properly trained with the ethics of forestry management; (ii) Political independence—regulatory body requires statutory protection from political interference, similar to Ghana's Public Utilities Regulatory Commission established under Act 538 (1997); (iii) Financial sustainability—proposed forest regulatory levy of 2% on timber revenues could generate estimated ₵12 million annually, sufficient for 50-person regulatory agency based on comparable institutions. Accountability of the proceeds of the levy will build credibility and ensure an impactful process.

4 | Discussion

Results from this study reveal that institutional operations are changed under the above-mentioned regulations (FSC and SFI). These changes are evident in environmental/forestry practices,

economic improvement and social/legal operations. Most of the certified forestry institutions express interest in the renewal of their accreditation. Environmental/forestry management shows the optimum impact felt under FSC, which is followed by economic impact and with social/legal impacts being the least. Higher economic out-turn was attributed to the SFI, followed by environmental/forestry management practices. Although the regulatory frameworks do not have the same score in each of the pillars of sustainability, overall environmental, social and economic impacts were realised and significant changes were made. Specific to the FSC, forest inventory programmes were the significant changes made for environmental requirements. Chain of custody, community engagement and stakeholder consultation also experienced a significant impact with FSC.

SFI also recorded its significant margins with its organisations such as the reduction of waste from wood (as shown in Table 6).

This study is in agreement with a scholarly work by [32] which acknowledges that independent regulatory frameworks in the forestry sector have significant impact in the management operations of organisations. In Ghana, the education sector has third-party independent regulators from basic to tertiary which ensures that educational institutions deliver on quality and international standards. Qualifications earned outside Ghana are adequately verified by these independent regulators in the education sector in order to ensure that standards set in the education sector are met. The forestry sector in Ghana is bedevilled with illegal logging, and all forms of environmental destruction only have a knee-jerk approach to mitigating these problems. An independent regulator's role is to minimise/at best prevent these anti-environmental activities from happening through its standards.

This emphasises the role of independent third-party audit practices to ensure that critical livelihood forestry projects such as MTS meet certain international benchmark standards. This paper provides a voice to further develop Ghana's interim FSC forest stewardship standard as it will help ensure that the operations of MTS are economically viable to the community people, practices of MTS conserve biodiversity, protect the soil and ecological continuity. It will also ensure that other social benefits from MTS are made available to the community people. This certification system, FSC, if fully developed, will help improve upon FSC and ensure that the practices of MTS adequately meet the tenets of sustainability. It will also serve as a neutral platform for fairly addressing the concerns of MTS farmers. Procuring logistical tools such as GIS software, computers, equipment for monitoring of forests, remote sensors, drones amongst others would be made available to the forestry institutions through its regulatory authorities. This will demonstrate Ghana's commitment in sustainable forest management and environmental issues as a whole to the international nations. Ghana is a developing country and working towards achieving the global goals just like Myanmar where MTS started from as shifting cultivation. Annual budgetary allocations made for the education (tertiary) through its regulator GTEC is a testament to achieving the global goal on quality education (SDG-4). The fundamental question here is what about the other global goals related to food (SDG-2), economic empowerment (SDG-8) and life on land (SDG-15). These questions place relevance to the roles of regulatory frameworks in meeting the objectives of the MTS.

5 | Conclusion and Recommendation

With reference to the study objectives of this paper, this study found that FSC- and SFI-certified institutions (and activities) show considerable managerial changes in their institutional operations. The strength each system has on its organisation with regards to individual requirements/standards suggests that the organisation is making progress in those areas. This regulatory framework provides an opportunity for organisations to carry out continual improvement in areas they have low points. This analysis demonstrates three key findings: (i) Ghana's current FC oversight of MTS lacks systematic performance monitoring, evidenced by Narh [1]. Narh [1] indicated in his findings that since the introduction of the MTS more than two decades ago, there has been no performance monitoring to inform future decisions on how to improve upon it. (ii) International certification models offer adaptable frameworks for independent forest regulation. (iii) Establishing forest regulatory authority requires specific institutional prerequisites. We recommend pilot testing-independent monitoring in three forest districts before nationwide implementation with a possible change of name from MTS to Forestry Livelihood Programme (which relates well with people by providing clearer understanding with its name). As stated above in Section 3.1 that the establishment of FSC was made possible by the hard work and commitment of NGOs, environmentalists and other independent associations, it provides an exemplary roadmap for a successful implementation since environmentalists and independent associations have the requisite skills for its establishment. Strong and independent legal framework, reliable monitoring devices and technologies, well-trained human resources and continuous capacity building are very important resources required. Since this is a sustainability project, the long-term benefits outweigh the short-term investments/benefits. All stakeholders in the forestry sector including academics, foresters and government officials have a duty to help improve upon the gains of various forestry initiatives. Regulatory practices and frameworks in the forestry sector (as done in the United States, Canada, Germany, etc.) result in improved managerial and institutional forestry practices. Regulators find sustainable ways of improving the weaknesses of certified forest organisations.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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